

Chapter 6.8

Laboratory safety and health

This could be you . . .

Hydrofluoric acid overflowed from a container. A worker tried to clean it up with paper towels and only caused more vapors. The worker experienced delayed symptoms and received severe chemical burns to his hands and lungs.

A glass separator funnel ruptured from being shaken and sprayed a chemical on a chemist. The chemist was wearing safety glasses, lab coat, and gloves. After washing off the chemical, the chemist was okay.

A laboratory worker broke a glass laboratory device he was working on and cut his finger.

1. Applicability of this chapter

You are required to follow this chapter if you work in a laboratory, as described in paragraph 2 below, or supervise those who work in a laboratory.

2. What is a laboratory?

In this chapter the term “laboratory” will be used as it is defined in the OSHA Standard 29 CFR 1910.1450, “Occupational Exposure to Hazardous Chemicals in Laboratories.” Therefore, laboratory means “a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis for analysis or research.” It involves “work with substances in which the containers used for reactions, transfers, and other handling of substances . . . are designed to be easily and safely manipulated by one person.”

3. Requirements for working in a laboratory

You shall follow the requirements in this chapter, 29 CFR 1910.1450, “Occupational Exposure to Hazardous Chemicals in Laboratories,” and:

- a. Use engineering and administrative hazard controls as much as possible.
- b. Follow your laboratory’s chemical hygiene plan and standard operating procedures.

4. Chemical hygiene plans

If your laboratory uses hazardous chemicals, your supervisor shall make sure that the laboratory has a written chemical hygiene plans (CHPs). Your laboratory may have its own CHP, or it may use a CHP that covers several laboratories in your organization. Review your CHP and evaluate its effectiveness at least yearly and update it as necessary. Send your

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written CHP to the Occupational Health Department (SD33) for review. A CHP shall include:

- a. Methods to protect workers from chemical hazards in the laboratory and keep exposure levels below any OSHA or NASA permissible exposure limits (PELs) or below any ACGIH threshold limit values (TLVs).
- b. Methods to provide extra protection from carcinogens, reproductive toxins, and acute toxins. Extra protection shall include:
 1. An area set aside for these chemicals.
 2. Devices to contain or control these chemicals.
 3. Procedures for safely removing wastes contaminated by these chemicals.
 4. Decontamination procedures.
- c. Operating procedures for safely using hazardous chemicals in the laboratory.
- d. Criteria to decide what control measures to use to reduce the chance of a dangerous chemical exposure. Control measures may include engineering controls, PPE, or safe work practices.
- e. Requirements to make sure that laboratory safety equipment such as fume hoods, emergency showers, and eyewashes work properly.
- f. Provisions for worker information and training, as described in paragraph 12 of this chapter.
- g. Criteria to decide when a particular laboratory activity requires prior approval from the laboratory supervisor.
- h. Provisions for workers to get medical help, as described in paragraph 13 of this chapter.
- i. A list of personnel responsible for implementing the plan that includes chemical hygiene officers.

5. Safe practices for working in a laboratory

When you work in a laboratory, you shall:

- a. Follow your laboratory's CHP and operating procedures. See paragraph 4 of this chapter for more details.
- b. Follow these requirements for exhaust hoods:
 1. Use hazardous chemicals under exhaust hood.
 2. Keep sashes at the 100 lfpm [linear feet per minute] mark when working at the hood face (150 lfpm mark for carcinogens).
 3. Always wear required PPE; even when working under a hood.

4. Make sure your exhaust hoods are evaluated by the Occupational Health Department annually and twice per year if carcinogens are used in the hoods.
5. Get approval from the Safety and Test Operations Division and the Occupational Health Department before using other exhaust methods.
- c. Keep exposure to hazardous chemicals in the laboratory to the lowest level practical. Never exceed the OSHA- or NASA-permissible exposure level for any chemical.
- d. Keep aisles and areas around safety equipment (e.g., eyewash stations and emergency showers) clear.
- e. Keep MSDSs for each chemical in your laboratory. Develop MSDSs for each chemical developed in your laboratory for use outside the laboratory as described in Chapter 9.2, "Hazard communication," of this handbook.
- f. Review any experiment that involves storing energy (e.g., mechanical, electrical, or chemical) for hazards before conducting it.
- g. Take precautions to prevent injuries from broken glass. Use the guide for safety in the chemical laboratory, Manufacturing Chemists Association Inc., "Handling Glassware."
- h. The laboratory safety representative or chemical hygiene officer should review changes in laboratory operations and chemicals before a procedure is conducted for the first time.
- i. Recipes for mixed chemical reagents should be scaled down whenever possible to the minimum quantity for the task.

6. Storing chemicals in a laboratory

When you store chemicals in your laboratory, you shall:

- a. Label all containers of laboratory chemicals, samples, and other materials. Don't remove or tear labels on incoming chemical containers. If a label on a chemical container becomes unreadable, put your own label on the container that identifies the chemical and its hazards. If you move a chemical to another container, properly label the new container.
- b. Keep MSDSs for hazardous chemicals where laboratory workers can easily find them during all duty hours.
- c. Keep an up-to-date inventory of the names and amounts of all hazardous chemicals in your laboratory at a given time.
- d. Keep only the smallest amount of chemicals possible in your laboratory. If your laboratory uses a large amount of chemicals in a short time, designate an internal chemical storage area. This area shall:
 1. Have enough ventilation.
 2. Be physically separated from workrooms.

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3. Provide separate storage for potentially reactive chemicals and incompatible materials.
 4. Have readily available a listing of all chemicals in the storage area.
 5. Include fire protection.
- e. Never use an exhaust hood for permanent chemical storage.

7. Monitoring chemical exposures in a laboratory

The Clinic Services Branch is responsible for monitoring chemical exposures during yearly inspections or because of complaints or requests. This office may write you and your coworker a report or post the results of a report on a bulletin board in your area. The Clinic Services Branch will:

- a. Sample chemical exposures to workers if it believes that chemical exposures could exceed PELs.
- b. Monitor chemical exposure periodically if earlier samples or monitoring shows exposures over PELs.
- c. Keep accurate records on any monitoring results. You have access to these records as described in 29 CFR 1910.20, "Access to Employee Exposure and Medical Records."

Note: Your supervisor must tell you the results within 15 days after he or she receives them.

8. Design requirements for laboratories

Laboratory designs shall meet these requirements:

- a. Follow National Fire Protection Association Standard 45, "Standard on Fire Protection for Laboratories Using Chemicals," and all federal and state requirements that apply.
- b. For new installations, laboratory hoods shall not be located adjacent to a single means of access to an exit or high-traffic areas.
- c. You shall provide a second means of access to an exit from a laboratory work area if any of the following situations exist (refer to Chapter 5.1 for exit widths between aisles):
 1. A laboratory work area contains an explosion hazard located so that an incident would block escape from or access to the laboratory work area.
 2. A laboratory work area within a Class A laboratory unit exceeds 46.5 m² (500 ft²).
 3. A laboratory work area within a Class B, Class C, or Class D laboratory unit exceeds 93 m² (1000 ft²).
 4. A hood in a laboratory work area is located adjacent to the primary means of exit access.

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5. A compressed gas cylinder larger than lecture bottle size [~5 cm × 33 cm (2 in. × 13 in.)] located such that it could prevent safe egress in the event of accidental release of cylinder contents.
 6. A cryogenic container located such that it could prevent safe egress in the event of accidental release of container contents.
- d. Install permanent pipes as much as possible to reduce the use of flex hoses and temporary tubing. Label all pipes.
 - e. Provide permanent gas-venting where venting of gases is needed.
 - f. Provide blast and fragment protection for operations that may cause explosions, implosions, or flying fragments such as high-pressure equipment, high-vacuum equipment, or explosive reactions.
 - g. Provide emergency eyewashes if hazardous chemicals are used. Provide emergency showers when hazard assessments, conducted by the Occupational Health Department, indicate the need. Locate emergency eyewashes and shower for quick drenching or flushing in accessible locations that require no more than 10 seconds to reach.
 - h. Include other design requirements and engineering controls; e.g., appropriate laboratory ventilation systems, from 29 CFR 1910.1450.
 - i. Meet the requirements in paragraph 3.9.2 and 3.9.5 of NPR 8715.3, “NASA General Safety Program Requirements.”

9. Emergency planning for laboratories

As a supervisor, you shall make sure that your laboratory has written emergency action plans that cover any possible emergencies in the laboratory and also make sure that all workers know what to do in an emergency. This includes making sure the laboratory has enough emergency equipment and supplies to deal with any emergency.

10. Protective equipment to use when working in a laboratory

You shall use:

- a. Any protective equipment such as gloves, aprons, or protective clothing required by a MSDS or OSHA standard for the chemicals you are working with.
- b. Respiratory protection if engineering or administrative controls don't keep chemical levels below PELs. See Chapter 7.2, “Respiratory protection,” of this handbook.

See Chapter 5.6, “Personal protective equipment,” of this handbook for more requirements on protective equipment.

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11. Training to have to work in a laboratory

You need to have briefings or training when you first come to work in the laboratory and whenever you change your work assignment in the laboratory. See Chapter 4.1, “Program Description” (for safety and health training), of this handbook for more information. You shall:

- a. Know:
 1. The contents of 29 CFR 1910.1450.
 2. Where you can find the CHP and needed reference material.
 3. Exposure limits for hazardous chemicals in the laboratory.
 4. Signs and symptoms of exposures to the chemicals in the laboratory.
 5. Where you can find MSDSs for laboratory chemicals.
 6. How to get medical help if you think you are exposed to chemical levels above PELs (see Chapter 3.6, “Occupational Healthcare Program,” of this handbook).
- b. Have initial and refresher training in:
 1. The physical and health hazards of chemicals in the laboratory.
 2. Hazard controls such as exhaust hoods, respirators, or special procedures to use to protect yourself and your coworkers.
 3. How to detect the presence of a hazardous chemical.
 4. How to enter and leave contaminated areas, and how to decontaminate yourself and others.
 5. Details of the CHP that applies to your work.
 6. Yearly emergency response training.
 7. Employee hazard reporting systems.

12. When you need to get medical help

JSC has a “Clinic First” policy for any injury for illness occurring at JSC, Sonny Carter Training Facility, or Ellington Field. We encourage all NASA civil servant and contractor employees to use the JSC Occupational Medicine Clinic as this clinic is tasked to provide occupational medicine evaluations to all employees. You or your supervisor should ensure you get to the JSC Occupational Medicine Clinic for medical evaluation and treatment. Using the JSC Occupational Medicine Clinic will ensure that you are seen by a licensed health care professional. If the exposure could be life-threatening, call your emergency number for an ambulance. The emergency numbers are:

NASA/JSC: extension 33333

Ellington Field: extension 44444

Sonny Carter Training Facility or off-site facility: 911

White Sands Test Facility: extension 5911

Follow these rules for medical help:

- a. You need medical help if:
 1. You notice signs or symptoms associated with a hazardous chemical to which you may have been exposed.
 2. Repeated exposure monitoring indicates exposure levels above PELs.
 3. You have a spill, leak, explosion, or other event in your laboratory that may have exposed you to a chemical above its PEL.
- b. Your supervisor shall give the doctor the following information:
 1. What chemicals you may have been exposed to
 2. How the possible exposure happened, and any quantitative data on the exposure
 3. What signs and symptoms you have, if any
- c. Your doctor will provide an opinion as described in 29 CFR 1910.1450(g)(4). The opinion will only cover job-related exposures and will include the examination results and recommendations for further medical action.
- d. JSC will keep accurate records on any medical help you receive as a result of a possible chemical exposure. You may see your records as described in 29 CFR 1910.20.

13. For more information on laboratory safety and health

You can find more information on laboratory safety and health in these documents:

- a. *Patty's Industrial Hygiene, Volumes 1-4*, 5th Ed., John Wiley & Sons, Inc., New York, NY, 2000
- b. *The Occupational Environment: Its Evaluation, Control, and Management*; Second Edition, American Industrial Hygiene Association, 2003
- c. *Accident Prevention Manual for Business and Industry, Administration and Programs*, 12th Edition; National Safety Council, 2001
- d. *Prudent Practices for Handling Hazardous Chemicals in Laboratories*, National Research Council, National Academy Press, Washington, DC, 1981
- e. ANSI/AIHA Z9.5-2003, "American National Standard for Laboratory Ventilation," 2003
- f. *Industrial Ventilation, a Manual of recommended Practice*, 25th Ed., The American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio, 2004